

portion of the sand of the Libyan Desert has been proved to consist of such grains. It is only in Nubia above Syene that the desert sand becomes a pure detritus of granite*.

11. In the various countries of the earth in which occur white and earthy, as well as coloured and compact rocks, composed of microscopic calcareous animalcules, the genera and species of these animalcules present so striking an agreement with those of the white chalk of Rügen, that they may well be deemed characteristic of one and the same period of geological formation. It cannot be asserted for a certainty that the same forms have been observed any where else†.

12. In the beds subjacent to and more ancient than the chalk, namely, in those of the Oolite or Jura limestone formation, we have also clear evidence of the existence of other microscopic Polythalamia. These, however, are such as have not hitherto been found anywhere in the chalk.

13. The early assertion that *all* limestone was the produce of animals‡, though resting on no sufficient foundation, and therefore justly held in slight regard by modern geologists, yet now deserves every attention, since it clearly appears that a limestone formation widely extended on the surface of the earth is composed of microscopic animals, visibly converted in a gradual manner into inorganic chalk and compact limestone. If similar phænomena appear also in the Jura limestone formation, and should become still further confirmed, these considerations (combined with the long-known existence of coarser corals and shells in both formations) tend to show how necessary it is, when examining the composition of any considerable portion of the solid mass of the earth, to strengthen our natural senses by artificial means, in order to obtain a distinct knowledge of the extent to which organic life may have contributed to its production.

14. The extreme minuteness of the chalk animalcules is strikingly proved by this, that even in the finest levigated whiting multitudes of them are still present, and may be applied without suffering change to the most varied technical purposes. Thus in the chalk coating given to painted chambers, paper, or even glazed visiting-cards (when not coated with white lead

* On these very interesting and not easily developed relations, I hope, at a future day, to be able to make a more special communication.

† If I have applied the same name in some cases both to animalcules of the chalk and to forms existing in the present sea-sand, or in recent fossil beds, it has arisen partly from my being unacquainted with the original forms of the latter, and partly from my desire not to create unnecessary perplexity by the adoption of new names. It should be observed that they are distinguished by marks of interrogation. All those which I could really compare were different.

‡ By Linnæus in 1745 and 1748, and Buffon in 1749.

alone), may be seen a pretty mosaic of well-preserved, moss-coral animalcules, but which are invisible to the naked eye. And thus our natural vision receives from such a surface the impression of the purest white, little deeming that it contains the bodies of millions of self-existing beings, of varied and beautiful forms, more or less closely crowded together (as in Plate IV., where the subjects are magnified 300 times).

Explanation of the Plates and Tabular View.

The Memoir is accompanied by four Plates*, presented with the view of facilitating a comparison between the organic relations of minute fossil bodies invisible to the naked eye, and those of still living bodies visible to the naked eye.

Thus the first three Plates exhibit recent small bodies naturally visible, with which the naturally invisible forms of the fourth Plate may be readily associated.

The first three Plates serve also to elucidate the true nature of the Polythalamia (hitherto mistaken), showing their greater affinity to the Bryozoa (Flustra) than to all other animal forms, and in particular the great difference there is between them and Cephalopods and Infusoria. They represent partly the unfolded, soft, external parts of living subjects, and partly dead, naked bodies, artificially divested of their calcareous shell, and not hitherto figured.

Lastly, these first three Plates serve to convey a view, according to some of their principal divisions, of the structure of the whole group of forms occurring in Polythalamia, and in particular to illustrate their frequent assemblage in families, or Polyparies, as they are termed. Plate I. contains simple forms; Plates II. and III. composite or family forms, Polyparies; of which Plate II. contains family forms assembled in single rows, and Plate III. family forms arranged in many rows.

If, as already observed, we examine a wall or paper whitened with finely levigated chalk, or a glazed visiting-card not coated with white lead alone, but also with chalk, they would appear, when magnified 300 times, more or less rich in subjects, as represented in Plate IV.

Plate I. contains *simple recent Polythalamia* from the sea-sand of Rimini. Fig. 1. *Rotalia Beccarii*; the shell only was known, but the figures show also the form of the animal when deprived of its shell by an acid, the form of both being the same. Fig. 2. *Marginulina Raphanus* (*Nodosaria Raphanus*, *Nautilus Raphanus priorum*), also very common at Rimini and other Italian coasts, and which had hitherto been erroneously ranked with Orthocera.

Plate II. contains *Polyparies of recent Polythalamia assem-*

* These plates do not accompany Mr. Weaver's paper.

bled in single rows, from the Red Sea and the Mediterranean. The two subjects represented in this Plate were collected by me in the year 1823, and it is peculiarly interesting, through my newly-discovered method of observing*, to have been able to see in several divisions of the internal body the remains of the siliceous Infusoria, of which they had made a repast fifteen years before. Fig. 1. *Peneroplis planatus*, d'Orbigny, *Nautilus planatus* of Fichtel and Moll, from the Red Sea. The shells of this animalcule were hitherto only known, but the soft organic animal form which they inclose is here also represented. Fig. 2. *Coscinospira Hemprichii*, a form from the Red Sea, also found in the Libyan part of the Mediterranean, and which was formerly erroneously placed adjoining the *Spirula* of the Cephalopods, and more recently as connected, through *Lituolites nautiloides*, with *Spirolina*.

Plate III. contains *Polyparies of recent Polythalamia assembled in many rows*. This Plate contains the only living animalcule of the Polythalamia group, hitherto so far observed as to admit of its classification. The three forms given in this Plate, constructed of many rows of animalcules, may be distinctly associated with the Flustra and Eschara of the Bryozoa, to which, through the well-known *Lunulites* and *Orbitulites* (hitherto ranked with coral animals), they approximate in a convincing manner. Fig. 1. *Orbiculus numismalis*, from the sea-sand of the Antilles Isles. Fig. 2. *Sorites orbiculus* = *Nautilus orbiculus*, Forskål, *Nummulina* (*Assilina*) *nitida*, d'Orbigny,? from the Red Sea. The same species lives also in the Mediterranean. In a part magnified 300 times we see the animalcule with eight feelers protruding from its cell. In some of the cells may be seen distinct shells of siliceous Infusoria; in others appear oviform globules. Fig. 3. *Amphisorus Hemprichii* closely resembles the *Sorites*; but it has cells on both sides bearing single animalcules, and hence

* The new method of observing is the following:—Place a drop of water upon a lamina of mica, and put into it of scraped chalk as much as will cover the fine point of a knife, spreading it out and leaving it to rest a few seconds; then withdraw the finest particles which are suspended in the water, together with most of the water, and let the remainder become perfectly dry. Cover this remainder so spread out with *Canadian balsam*, the turpentine of the *Pinus* (*Abies*) *balsamea*, and hold it over a lamp until it becomes slightly fluid without froth. A preparation thus made seldom fails, and when magnified 300 times in diameter we see that the mass of the chalk is chiefly composed of minute well-preserved organisms. In this preparation all the cells of the Polythalamia appear at first black with a white central spot, which is caused by the air contained in the cells, which, as is well known, appear under water as annular black bodies; but by degrees the balsam penetrates into all the single cells, the black rings of the air vesicles disappear, and we recognize all the small cells of the Polythalamian animals, often presenting a very pretty appearance.